



# Chunghwa Picture Tubes, Ltd.

## Technical Specification

To : **DDL.**

Date : 2008/07/16

*CPT TFT-LCD*

**CLAA 201WA 04**

**ACCEPTED BY :**

| APPROVED BY       | CHECKED BY     | PREPARED BY                                                         |
|-------------------|----------------|---------------------------------------------------------------------|
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Prepared by : Design General Division

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|          |                                            |             |                   |
|----------|--------------------------------------------|-------------|-------------------|
| Doc. No: | <b>CLAA201WA04 -DDL- Ver.1 -2008/07/16</b> | Issue Date: | <b>2008/07/16</b> |
|----------|--------------------------------------------|-------------|-------------------|

## Modification Record List

[illegible]



## 1.OVERVIEW

CLAA201WA04 is 20.1”(51.11cm) color TFT-LCD (Thin Film Transistor Liquid Crystal Display) module composed of LCD panel, LVDS driver ICs, control circuit and backlight(CCFL, 4 tubes). By applying 8 bit digital data (6bits+Hi-FRC), 1680×1050, driven by 5 voltages,16.7M-color images are displayed on the 20.1” diagonal screen. The module structure is fixed by iron frame,without the inverter for the backlight. Interface of data and control signals is typ.General specification are summarized in the following table:

| ITEM                           | SPECIFICATION                                  |
|--------------------------------|------------------------------------------------|
| Display Area(mm)               | 433.44 (H) × 270.9 (V) (20.1-inch diagonal)    |
| Number of Pixels               | 1680 (H) × 1050(V)                             |
| Pixel Pitch(mm)                | 0.258(H) × 0.258(V)                            |
| Color Pixel Arrangement        | RGB vertical stripe                            |
| Display Mode                   | NormallyWhite, TN                              |
| Number of Colors               | 16.7M(6bits+Hi-FRC)                            |
| Brightness(cd/m <sup>2</sup> ) | 300cd/m <sup>2</sup> (Typ.)(center, 7.5mA)     |
| Viewing Angle(H/V)             | 170/160 (Typ.)                                 |
| Surface Treatment              | Anti-glare, 3H                                 |
| Power consumption(W)           | 27.5(Typ.) (w/o Inverter)                      |
| Module Size(mm)                | 459.4(W) × 296.4(H) ×16.6 (D) (Typ.)           |
| Module Weight(g)               | 3100(max)                                      |
| Backlight Unit                 | CCFL, 4 tubes(top × 2/bottom × 2) , Edge light |

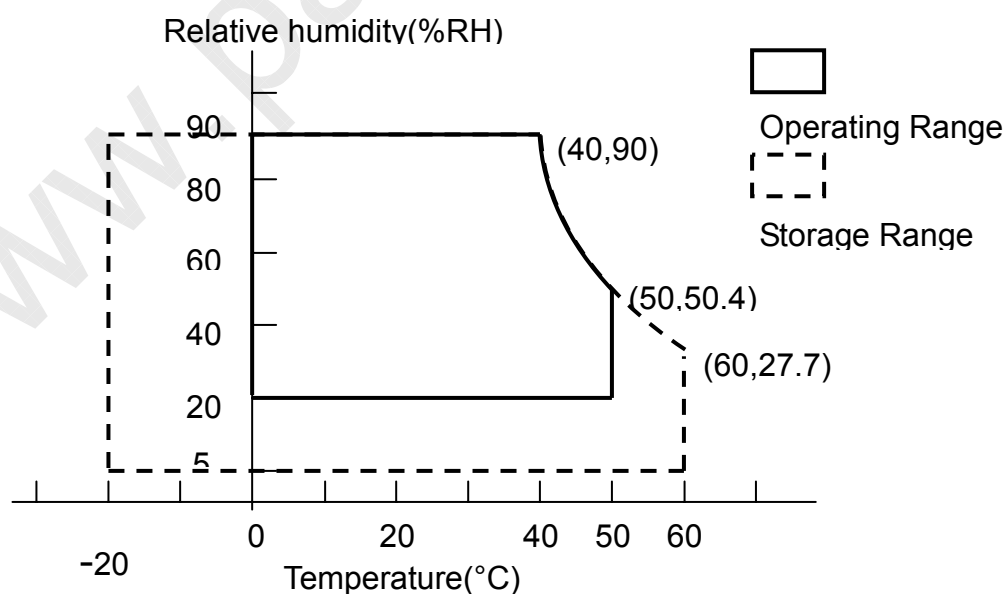
## 2.ABSOLUTE MAXIMUM RATINGS

The following are maximun values which, if exceeded, may cause faulty operation or damage to the unit.

| ITEM                                | SYMBOL | MIN.  | MAX. | UNIT  | Remark          |
|-------------------------------------|--------|-------|------|-------|-----------------|
| Power Supply Voltage For LCD        | VCC    | 0     | 6.5  | V     | --              |
| Lamp Voltage                        | VL     | 765   | 940  | Vrms  | --              |
| Lamp Current                        | ILO    | 3     | 8    | mArms | *4). 7)         |
| Lamp Frequency                      | FL     | 40    | 80   | kHz   | --              |
| Electrostatic Voltage               | VESDt  | -200  | 200  | V     | *5)             |
|                                     | VESDc  | -8000 | 8000 | V     |                 |
| Operation Temperature (Surrounding) | Top    | 0     | 50   | °C    | *1). 2). 3). 6) |
| Storage Temperature                 | Tstg   | -20   | 60   | °C    | *1). 2). 3)     |
| Delayed Discharge Time              | TD     | --    | 1    | sec   | *8)             |

## [Note]

- \*1) The relative temperature and humidity range are as below sketch, 90%RHMax. ( $T_a \leq 40^\circ\text{C}$ )
- \*2) The maximum wet bulb temperature  $\leq 39^\circ\text{C}$  ( $T_a > 40^\circ\text{C}$ ) and without dewing.
- \*3) If you use the product in a environment which over the definition of temperature and humidity too long to effect the result of eye-atching.
- \*4) Product life-time related to lamp current, pls operate the production follow statement at page 9 CN2, 4 (BACKLIGHT)
- \*5) The testing conditions are according to IEC 1000-4-2 specification :  
 VESDt : By using contact-mode to discharge each pin of the connector.  
 VESDc : By using contact-mode to discharge the module.
- \*6) If you operate the product in normal temperature range, the center surface of panel should be under  $60^\circ\text{C}$ .  
 Humidity  $\leq 85\%\text{RH}$  without condensation.  
 Relative Humidity  $\leq 90\%$  ( $T_a \leq 40^\circ\text{C}$ )  
 Wet Bulb Temperature  $\leq 39^\circ\text{C}$  ( $T_a \geq 40^\circ\text{C}$ )
- \*7) When lamp current over the definition of absolute maximun, product life-time will decay rapidly or operate unusual. If lamp current is under 3.0mA, the lamp could be abnormal-starting.  
 If for special request testing,then the minimun value of current is 2mA.It is not to promise product life-time and lighting in normally situation.
- \*8) Delayed discharge time test condition:  
 Starting lamp voltage = 1700 Vrms  
 Before test TD, lamp should operate at least 1min. , and lamp current should follow typical lamp current specification. To place panel at room temp. ( $25 \pm 2^\circ\text{C}$ ) below for 24hr, and then to measure TD with the same starting lamp voltage in dark room.



### 3. ELECTRICAL CHARACTERISTICS

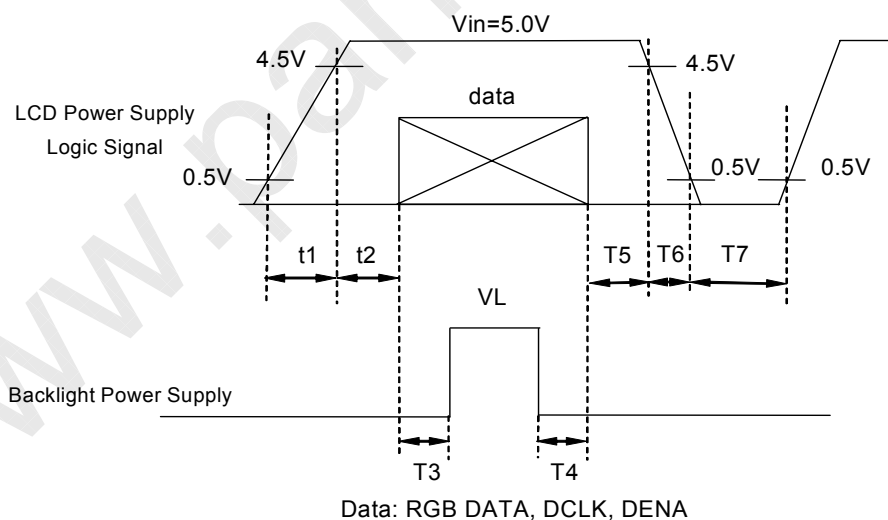
#### (1).TFT-LCD

Ta=25℃

| ITEM                                 |                                           | SYMBOL | MIN   | TYP  | MAX   | UNIT  | REMARK   |
|--------------------------------------|-------------------------------------------|--------|-------|------|-------|-------|----------|
| Power Supply Voltage for LCD         |                                           | VCC    | 4.5   | 5.0  | 5.5   | V     | *1)      |
| Power Supply Current for LCD         |                                           | ICC    | --    | 900  | 1500  | mA    | *2)      |
| Permissible Ripple Voltage for Logic |                                           | VRP    | --    | --   | 100   | mVp-p | VCC=5.0V |
| Differential Resistance              |                                           | Zm     | 90    | 100  | 110   | Ω     |          |
| LVDS:<br>IN+ , IN-                   | The same motion input Voltage             | VCM    | 1.125 | 1.25 | 1.375 | V     | *3)      |
|                                      | Differential input Voltage                | VID    | 250   | 350  | 450   | mV    |          |
|                                      | High electric potential threshold voltage | VTH    | -     | -    | 100   | mV    |          |
|                                      | Low electric potential threshold voltage  | VTL    | -100  | -    | -     | mV    |          |
| LCDInrush Current                    |                                           | Inrush | -     | -    | 3     | A     | *4)      |
| Power consumption                    |                                           | P      | -     | 4.5  | 7.5   | W     | *2)      |

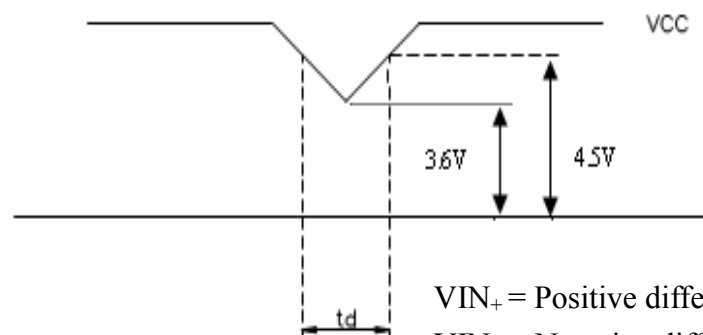
[Note]

\*1)Power 、data sequence

 $0.5\text{ms} < t1 < 10\text{ms}$  $0 < t2 < 50\text{ms}$  $t3 > 250\text{ms}$  $t4 > 200\text{ms}$  $0 < t5 < 50\text{ms}$  $0.01\text{ms} < t6 < 10\text{ms}$  $t7 > 1\text{sec}$ 

VCC-dip conditions:

- (1) When  $3.6\text{V} \leq V_{\text{CC}}(\text{min}) < 4.5\text{V}$ :  $t_d \leq 10\text{ ms}$
- (2) When  $V_{\text{CC}} < 3.6\text{V}$ , VCC-dip conditions should also follow the VCC-turn-on conditions.

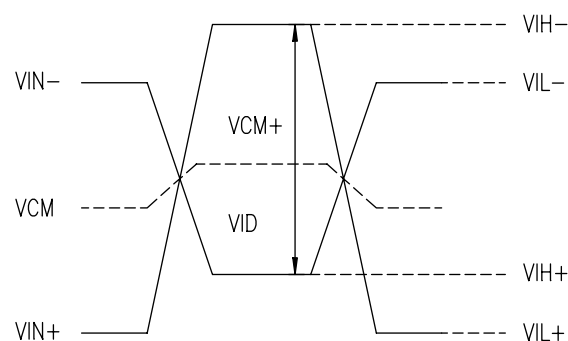
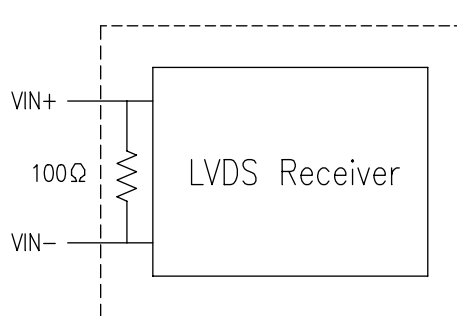


- 2). Typical value is measured when displaying horizontal gray scale line pattern:

64 gray level, 1680 line mode

$V_{\text{CC}}=5.0\text{ V}$ ,  $f_{\text{H}}=65\text{ kHz}$ ,  $f_{\text{V}}=60\text{ Hz}$ ,  $f_{\text{CLK}}=73.5\text{ MHz}$

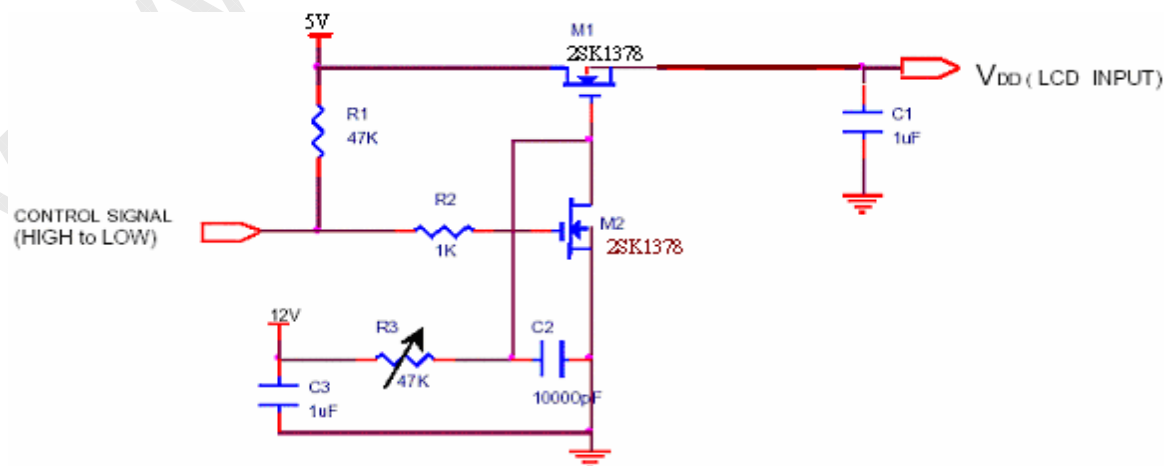
- 3).LVDS Signal definition:

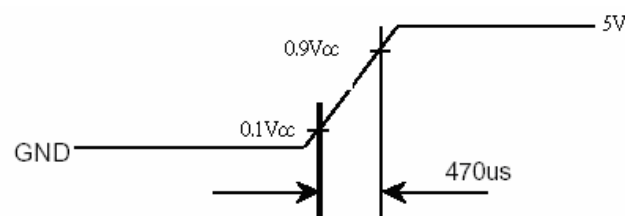


VIN+ : Positive differential DATA & CLK Input

VIN- : Negative differential DATA & CLK Input

- 4).Irush Measurement Condition





## (2). Backlight

### 1. Electrical specification

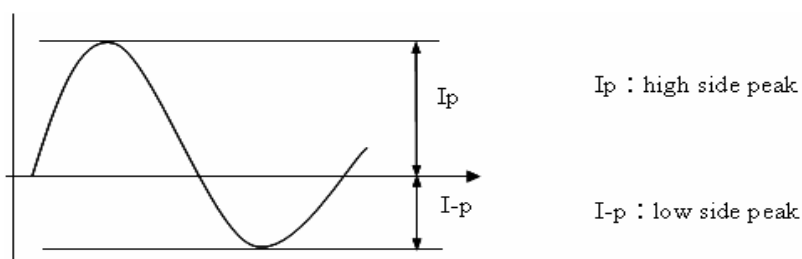
| ITEM                                      | SYMBOL | MIN | TYP | MAX  | UNIT  | REMARK              |
|-------------------------------------------|--------|-----|-----|------|-------|---------------------|
| Lamp Voltage                              | VL     | 690 | 770 | 850  | Vrms  | IL=7.5mA<br>Ta=25°C |
| Lamp Current(Standard)                    | IL     | 7.0 | 7.5 | 8.0  | mArms | *1) Ta=25°C         |
| Lamp Current(Operation)                   | ILO    | 3.0 | 7.5 | 8.0  | mArms | *1) Ta=25°C         |
| Lamp Power Consumption<br>(for reference) | WL     | —   | 25  | —    | W     | IL=7.5mA<br>Ta=25°C |
| Inverter Frequency                        | FI     | 40  | —   | 80   | kHz   | *1) *2) Ta=25°C     |
| Starting Lamp Voltage                     | VS     | —   | —   | 1600 | Vrms  | *5) Ta=0°C          |
|                                           |        | —   | —   | 1400 | Vrms  | *5) Ta=25°C         |

### 2. Lamp life time

| ITEM                           | IL at 3.0 mA | IL at 7.5 mA | IL at 8 mA  | UNIT | REMARK                  |
|--------------------------------|--------------|--------------|-------------|------|-------------------------|
| Lamp Life Time                 | Min. 50,000  | Min. 40,000  | Min. 30,000 | hr   | Continuous Operation*3) |
| Turn-on and Turn-off Operation | --           | Min.100,000  | --          | time | Continuous Operation*4) |

[Note] Inverter vender : Sumida, model : IV50167/T

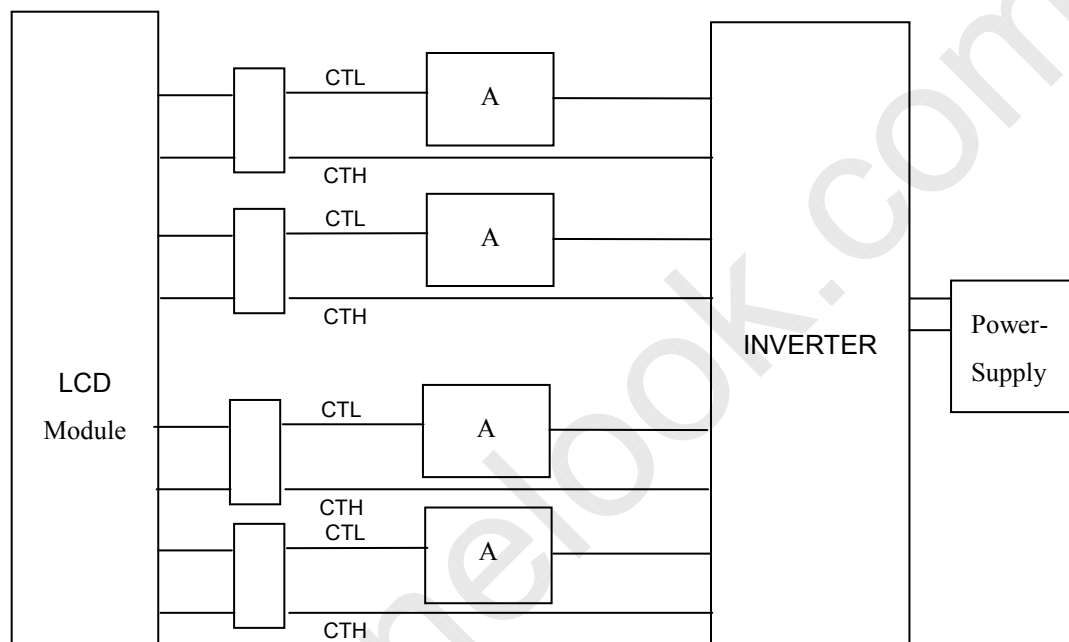
If the waveform of light up-driving is asymmetric, the distribution of mercury inside the lamp tube will become unequally or will deplete the Ar gas in it. Then it may cause the abnormal phenomenon of lighting-up. Therefore, designers have to try their best to fulfill the conditions under the inverter designing-stage as below:



A : The degrees of unbalance =  $|I_p - I-p| / I_{rms} \times 100 (\%)$

B : The ratio of wave height =  $I_p$  (or  $I-p$ ) /  $I_{rms}$

### 1) Lamp Current measurement method (The current meter is inserted in cold line)



- \*2)
- Frequency in this range can make the characteristics of electric and optics maintain in  $\pm 10\%$  except color coordinates.
  - Frequency in 50~60kHz can make characteristics of electric and optics better.
  - Frequency in 45~75kHz won't damage the lifetime and reliability of lamp.
  - Lamp frequency of inverter may produce interference with horizontal(or vertical) synchronous frequency, and this may cause horizontal beat on the display. Therefore, please adjust lamp frequency, and keep inverter as far from module as possible or use electronic shielding between inverter and module to avoid the interference.

### \*3) Definition of the lamp life time :

- Luminance (L) under 50% of specification.
- Starting Lamp Voltage: over 130% of the initial value.  $T_a = 25^\circ\text{C}$

### \*4) The condition of Turn-on and Turn-off operation is as below:

- Lamp current is 7.0mA
- Frequency is 10 sec.(on)/10 sec.(off)
- Repeat it for 100 thousand times





- d. The lamp hue variation must smaller than 0.03
- e. It should not have motion fail when starting lamp voltage is lower than 130%of the initial value.
- \*5) For keeping good lighting situation ,when design the inverter ,it must be considered that the voltage large than starting lamp voltage.
- \*6)  $WL=IL \times VL \times 4 \circ$  ( $IL=7mA$  ,  $Ta=25^{\circ}C$ )



## 4.INTERFACE PIN CONNECTION

### (1) CN1

Outlet connector: FI-XB30SSRL-HF16 (JAE) (or equivalent)

| PIN NO. | REMARK | FUNCTION                                  |
|---------|--------|-------------------------------------------|
| 1       | RXO0-  | minus signal of odd channel 0(LVDS)       |
| 2       | RXO0+  | plus signal of odd channel 0(LVDS)        |
| 3       | RXO1-  | minus signal of odd channel 1(LVDS)       |
| 4       | RXO1+  | plus signal of odd channel 1(LVDS)        |
| 5       | RXO2-  | minus signal of odd channel 2(LVDS)       |
| 6       | RXO2+  | plus signal of odd channel 2(LVDS)        |
| 7       | GND    | GND                                       |
| 8       | RXOC-  | minus signal of odd clock channel (LVDS)  |
| 9       | RXOC+  | plus signal of odd clock channel (LVDS)   |
| 10      | RXO3-  | minus signal of odd channel 3(LVDS)       |
| 11      | RXO3+  | plus signal of odd channel 3(LVDS)        |
| 12      | RXE0-  | minus signal of even channel 0(LVDS)      |
| 13      | RXE0+  | plus signal of even channel 0(LVDS)       |
| 14      | GND    | GND                                       |
| 15      | RXE1-  | minus signal of even channel 1(LVDS)      |
| 16      | RXE1+  | plus signal of even channel 1(LVDS)       |
| 17      | GND    | GND                                       |
| 18      | RXE2-  | minus signal of even channel 2(LVDS)      |
| 19      | RXE2+  | plus signal of even channel 2(LVDS)       |
| 20      | RXEC-  | minus signal of even clock channel (LVDS) |
| 21      | RXEC+  | plus signal of even clock channel (LVDS)  |
| 22      | RXE3-  | minus signal of even channel 3(LVDS)      |
| 23      | RXE3+  | plus signal of even channel 3(LVDS)       |
| 24      | GND    | GND                                       |
| 25      | NC     | NC                                        |
| 26      | NC     | Test pin (Can't connect to GND)           |
| 27      | NC     | NC                                        |
| 28      | VCC    | Power supply input voltage(5.0 V)         |
| 29      | VCC    | Power supply input voltage(5.0 V)         |
| 30      | VCC    | Power supply input voltage(5.0 V)         |

1) Keep the NC Pin and don't connect it to GND or other signals.

2) GND Pin must connect to the ground, don't let it be a vacant pin.

### (2) CN2, 3, 4, 5 (BACKLIGHT)

CN2、CN3、CN4、CN5：BHSR-02VS-1 (JST)

<Mating connector：SM02B-BHSS-1-TB (JST)>



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| No. | Pin | Symbol | Description                         |
|-----|-----|--------|-------------------------------------|
| CN2 | 1   | HV     | High Voltage Output for CCFL Lamp 1 |
|     | 2   | LV     | Low Voltage Output for CCFL Lamp 1  |
| CN3 | 1   | HV     | High Voltage Output for CCFL Lamp 2 |
|     | 2   | LV     | Low Voltage Output for CCFL Lamp 2  |
| CN4 | 1   | HV     | High Voltage Output for CCFL Lamp 3 |
|     | 2   | LV     | Low Voltage Output for CCFL Lamp 3  |
| CN5 | 1   | HV     | High Voltage Output for CCFL Lamp 4 |
|     | 2   | LV     | Low Voltage Output for CCFL Lamp 4  |

## 5.INTERFACE TIMING

### (1) Timing Characteristic

| ITEM       |      |            | SYMBOL                    | MIN.      | TYP. | MAX. | UNIT           |
|------------|------|------------|---------------------------|-----------|------|------|----------------|
| LCD Timing | DCLK |            | Freq.                     | $f_{CLK}$ | 61   | 73.5 | 83 MHz         |
|            |      |            | Cycle                     | $t_{CLK}$ | 12   | 13.6 | 16.4 ns        |
|            | DENA | Horizontal | Horizontal total time     | $t_H$     | 1030 | 1135 | 1300 $t_{CLK}$ |
|            |      |            | Horizontal effective time | $t_{HA}$  | 840  | 840  | 840 $t_{CLK}$  |
|            |      |            | Horizontal blank time     | $t_{HB}$  | 190  | 295  | 460 $t_{CLK}$  |
|            |      | Vertical   | Vertical frame Rate       | Fr        | 55   | 60   | 75 Hz          |
|            |      |            | Vertical total time       | $t_V$     | 1060 | 1080 | 1300 $t_H$     |
|            |      |            | Vertical effective time   | $t_{VA}$  | 1050 | 1050 | 1050 $t_H$     |
|            |      |            | Vertical blank time       | $t_{VB}$  | 10   | 30   | 250 $t_H$      |

[Note]

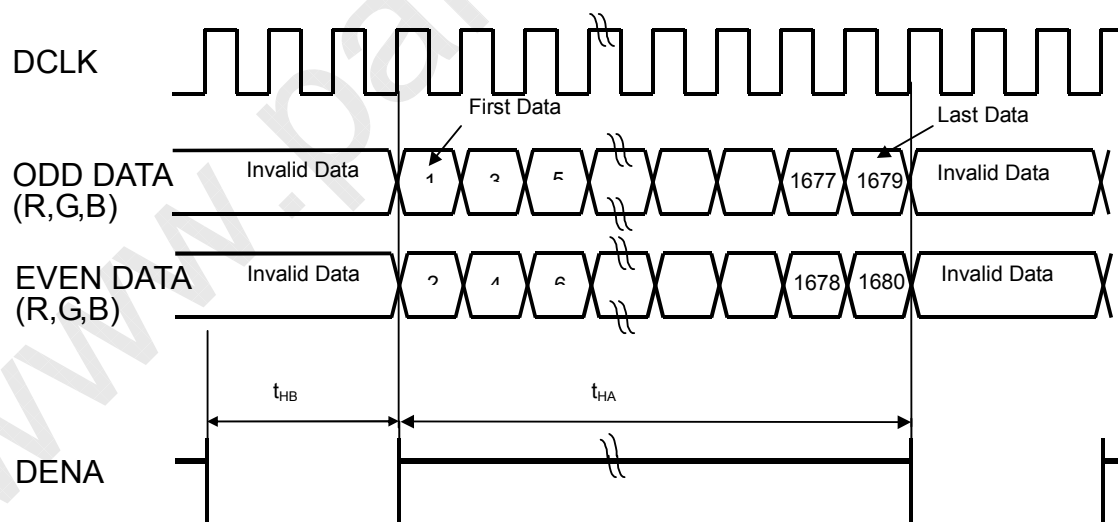
- \*1) DENA (data enable) usually is positive
- \*2) DCLK still inputs during blanking
- \*3) LVDS transmitter IC: : NT71671-00033(NVT)
- \*4) LVDS IC :

| Receiver        | Transmitter     |
|-----------------|-----------------|
| DS90C384MTD(NS) | DS90C383MTD(NS) |
| SN75LVDS82(TI)  | SN75LVDS83(TI)  |

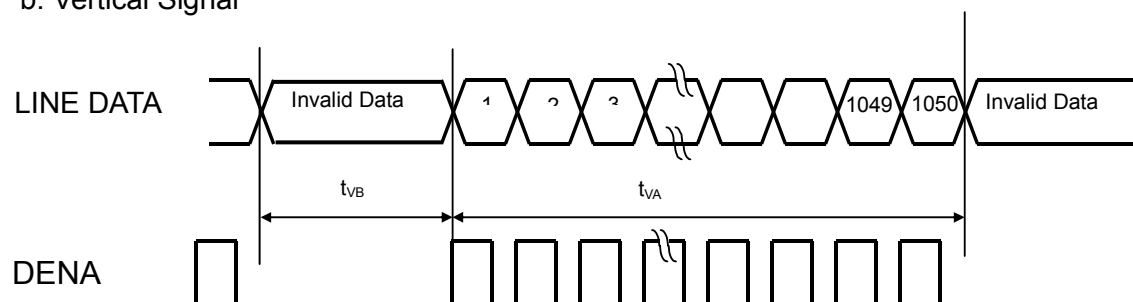
- \*5) DE mode only
- \*6) It maybe cause flicker at 55Hz

### (2).Timing Chart

#### a. Horizontal Signal

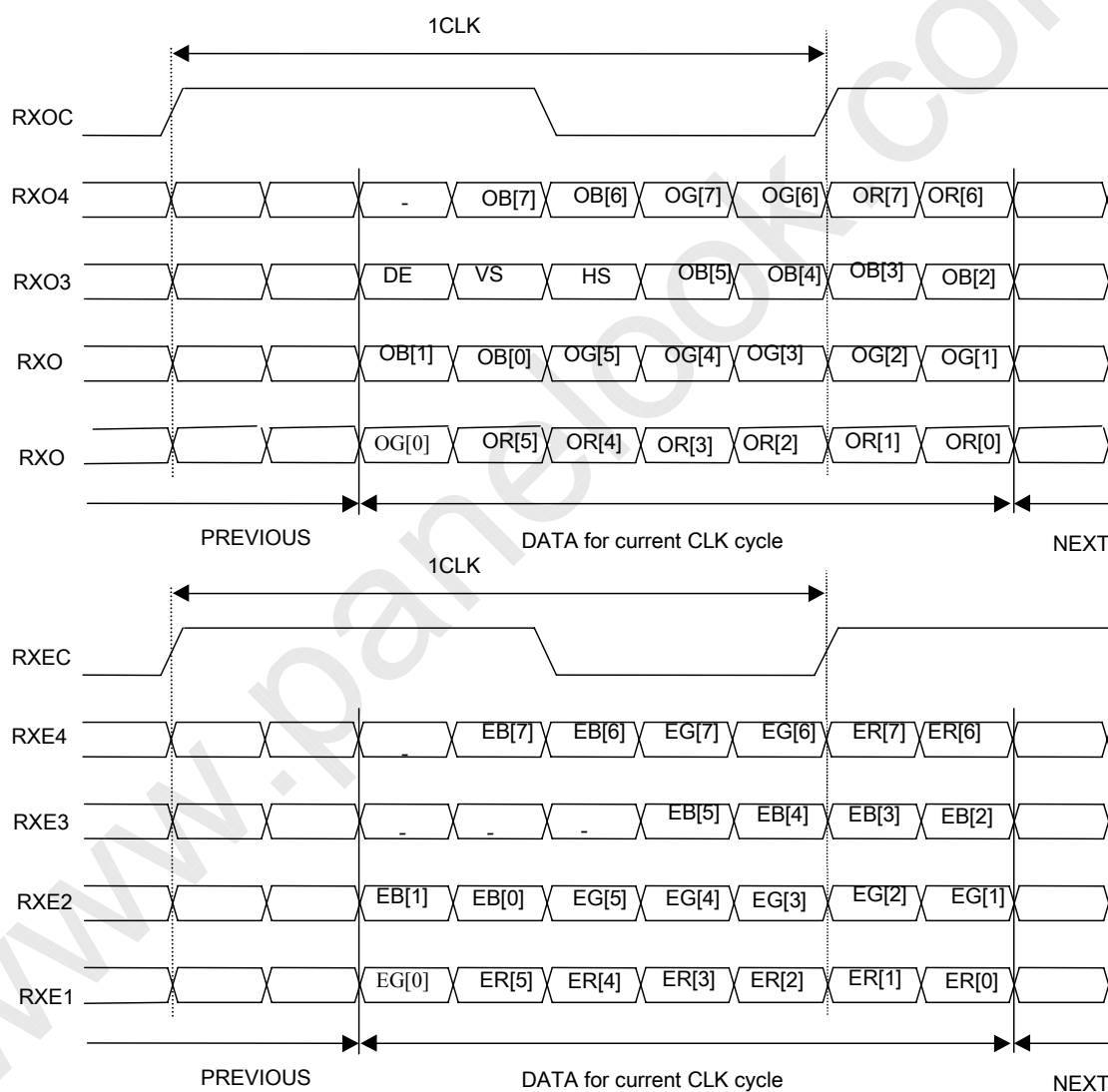


## b. Vertical Signal



## (3).LVDS Data

For 6Bit+Hi-FRC





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## Color Data Assignment

| COLOR       | INPUT DATA | R DATA |    |    |    |    |    |    |     | G DATA |    |    |    |    |    |    |     | B DATA |    |    |    |    |    |    |     |
|-------------|------------|--------|----|----|----|----|----|----|-----|--------|----|----|----|----|----|----|-----|--------|----|----|----|----|----|----|-----|
|             |            | R7     | R6 | R5 | R4 | R3 | R2 | R1 | R0  | G7     | G6 | G5 | G4 | G3 | G2 | G1 | G0  | B7     | B6 | B5 | B4 | B3 | B2 | B1 | B0  |
|             |            | MSB    |    |    |    |    |    |    | LSB | MSB    |    |    |    |    |    |    | LSB | MSB    |    |    |    |    |    |    | LSB |
| BASIC COLOR | BLACK      | 0      | 0  | 0  | 0  | 0  | 0  | 0  | 0   | 0      | 0  | 0  | 0  | 0  | 0  | 0  | 0   | 0      | 0  | 0  | 0  | 0  | 0  | 0  | 0   |
|             | RED(255)   | 1      | 1  | 1  | 1  | 1  | 1  | 1  | 1   | 0      | 0  | 0  | 0  | 0  | 0  | 0  | 0   | 0      | 0  | 0  | 0  | 0  | 0  | 0  | 0   |
|             | GREEN(255) | 0      | 0  | 0  | 0  | 0  | 0  | 0  | 0   | 1      | 1  | 1  | 1  | 1  | 1  | 1  | 1   | 0      | 0  | 0  | 0  | 0  | 0  | 0  | 0   |
|             | BLUE(255)  | 0      | 0  | 0  | 0  | 0  | 0  | 0  | 0   | 0      | 0  | 0  | 0  | 0  | 0  | 0  | 0   | 1      | 1  | 1  | 1  | 1  | 1  | 1  | 1   |
|             | CYAN       | 0      | 0  | 0  | 0  | 0  | 0  | 0  | 0   | 1      | 1  | 1  | 1  | 1  | 1  | 1  | 1   | 1      | 1  | 1  | 1  | 1  | 1  | 1  | 1   |
|             | MAGENTA    | 1      | 1  | 1  | 1  | 1  | 1  | 1  | 1   | 0      | 0  | 0  | 0  | 0  | 0  | 0  | 0   | 1      | 1  | 1  | 1  | 1  | 1  | 1  | 1   |
|             | YELLOW     | 1      | 1  | 1  | 1  | 1  | 1  | 1  | 1   | 1      | 1  | 1  | 1  | 1  | 1  | 1  | 1   | 0      | 0  | 0  | 0  | 0  | 0  | 0  | 0   |
|             | WHITE      | 1      | 1  | 1  | 1  | 1  | 1  | 1  | 1   | 1      | 1  | 1  | 1  | 1  | 1  | 1  | 1   | 1      | 1  | 1  | 1  | 1  | 1  | 1  | 1   |
| RED         | RED(0)     | 0      | 0  | 0  | 0  | 0  | 0  | 0  | 0   | 0      | 0  | 0  | 0  | 0  | 0  | 0  | 0   | 0      | 0  | 0  | 0  | 0  | 0  | 0  | 0   |
|             | RED(1)     | 0      | 0  | 0  | 0  | 0  | 0  | 0  | 1   | 0      | 0  | 0  | 0  | 0  | 0  | 0  | 0   | 0      | 0  | 0  | 0  | 0  | 0  | 0  | 0   |
|             | RED(2)     | 0      | 0  | 0  | 0  | 0  | 0  | 1  | 0   | 0      | 0  | 0  | 0  | 0  | 0  | 0  | 0   | 0      | 0  | 0  | 0  | 0  | 0  | 0  | 0   |
|             |            |        |    |    |    |    |    |    |     |        |    |    |    |    |    |    |     |        |    |    |    |    |    |    |     |
|             |            |        |    |    |    |    |    |    |     |        |    |    |    |    |    |    |     |        |    |    |    |    |    |    |     |
|             | RED(254)   | 1      | 1  | 1  | 1  | 1  | 1  | 1  | 0   | 0      | 0  | 0  | 0  | 0  | 0  | 0  | 0   | 0      | 0  | 0  | 0  | 0  | 0  | 0  | 0   |
|             | RED(255)   | 1      | 1  | 1  | 1  | 1  | 1  | 1  | 1   | 0      | 0  | 0  | 0  | 0  | 0  | 0  | 0   | 0      | 0  | 0  | 0  | 0  | 0  | 0  | 0   |
| GREEN       | GREEN(0)   | 0      | 0  | 0  | 0  | 0  | 0  | 0  | 0   | 0      | 0  | 0  | 0  | 0  | 0  | 0  | 0   | 0      | 0  | 0  | 0  | 0  | 0  | 0  | 0   |
|             | GREEN(1)   | 0      | 0  | 0  | 0  | 0  | 0  | 0  | 0   | 0      | 0  | 0  | 0  | 0  | 0  | 0  | 1   | 0      | 0  | 0  | 0  | 0  | 0  | 0  | 0   |
|             | GREEN(2)   | 0      | 0  | 0  | 0  | 0  | 0  | 0  | 0   | 0      | 0  | 0  | 0  | 0  | 0  | 1  | 0   | 0      | 0  | 0  | 0  | 0  | 0  | 0  | 0   |
|             |            |        |    |    |    |    |    |    |     |        |    |    |    |    |    |    |     |        |    |    |    |    |    |    |     |
|             |            |        |    |    |    |    |    |    |     |        |    |    |    |    |    |    |     |        |    |    |    |    |    |    |     |
|             | GREEN(254) | 0      | 0  | 0  | 0  | 0  | 0  | 0  | 0   | 1      | 1  | 1  | 1  | 1  | 1  | 1  | 0   | 0      | 0  | 0  | 0  | 0  | 0  | 0  | 0   |
|             | GREEN(255) | 0      | 0  | 0  | 0  | 0  | 0  | 0  | 0   | 1      | 1  | 1  | 1  | 1  | 1  | 1  | 1   | 0      | 0  | 0  | 0  | 0  | 0  | 0  | 0   |
| BLUE        | BLUE(0)    | 0      | 0  | 0  | 0  | 0  | 0  | 0  | 0   | 0      | 0  | 0  | 0  | 0  | 0  | 0  | 0   | 0      | 0  | 0  | 0  | 0  | 0  | 0  | 0   |
|             | BLUE(1)    | 0      | 0  | 0  | 0  | 0  | 0  | 0  | 0   | 0      | 0  | 0  | 0  | 0  | 0  | 0  | 0   | 0      | 0  | 0  | 0  | 0  | 0  | 1  | 0   |
|             | BLUE(2)    | 0      | 0  | 0  | 0  | 0  | 0  | 0  | 0   | 0      | 0  | 0  | 0  | 0  | 0  | 0  | 0   | 0      | 0  | 0  | 0  | 0  | 1  | 0  | 0   |
|             |            |        |    |    |    |    |    |    |     |        |    |    |    |    |    |    |     |        |    |    |    |    |    |    |     |
|             |            |        |    |    |    |    |    |    |     |        |    |    |    |    |    |    |     |        |    |    |    |    |    |    |     |
|             | BLUE(254)  | 0      | 0  | 0  | 0  | 0  | 0  | 0  | 0   | 0      | 0  | 0  | 0  | 0  | 0  | 0  | 0   | 1      | 1  | 1  | 1  | 1  | 1  | 1  | 0   |
|             | BLUE(255)  | 0      | 0  | 0  | 0  | 0  | 0  | 0  | 0   | 0      | 0  | 0  | 0  | 0  | 0  | 0  | 0   | 1      | 1  | 1  | 1  | 1  | 1  | 1  | 1   |

[Note] 1) Definition of gray scale: Color (n): n indicates gray scale level; higher n means brighter level.

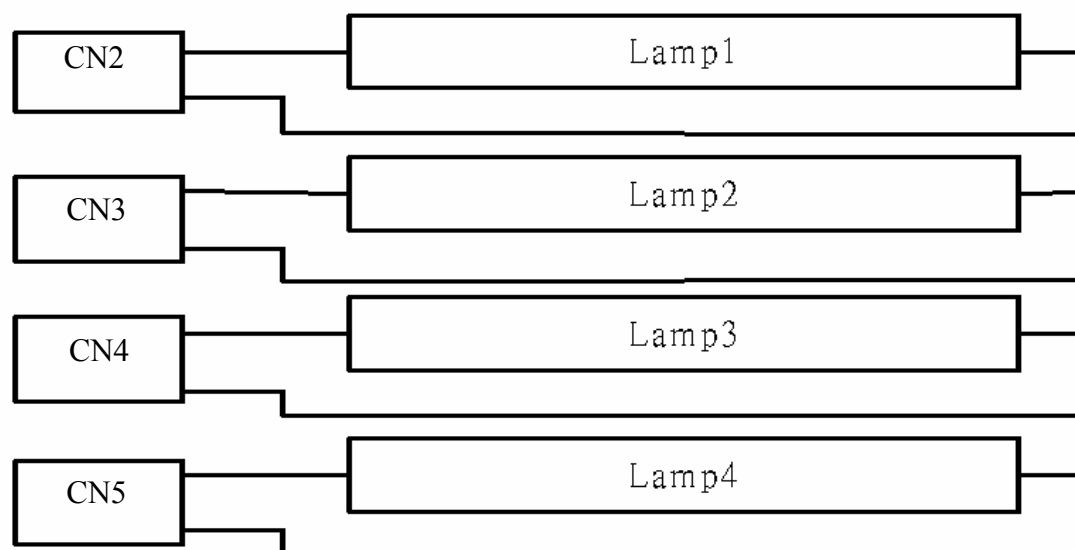
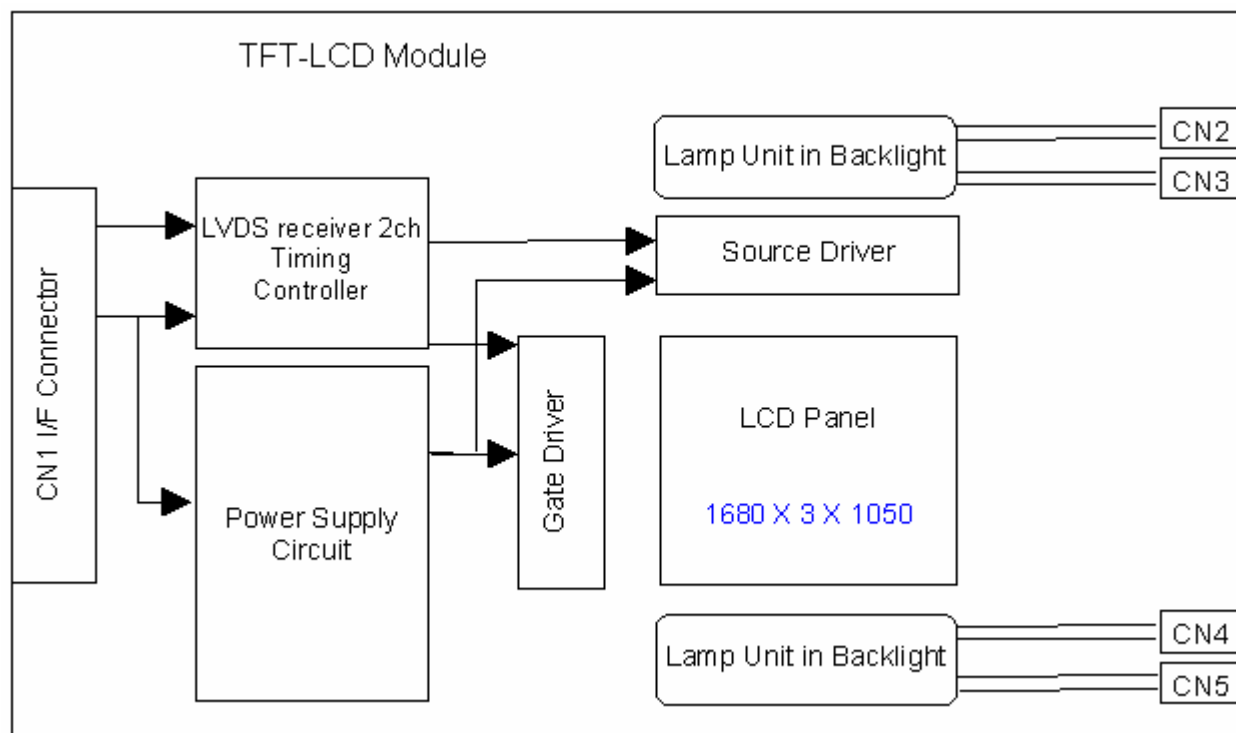
2) Data: 1-High, 0-Low.

3) For odd & even data also.

(4) .Color Data Distribution

|           |           |    |           |    |              |              |
|-----------|-----------|----|-----------|----|--------------|--------------|
| D(1,1)    | D(2,1)    | .. | D(X,1)    | .. | D(1679,1)    | D(1680,1)    |
| D(1,2)    | D(2,2)    | .. | D(X,2)    | .. | D(1679,2)    | D(1680,2)    |
| ..        | ..        | +  | ..        | +  | ..           | ..           |
| D(1,Y)    | D(2,Y)    | .. | D(X,Y)    | .. | D(1679,Y)    | D(1680,Y)    |
| ..        | ..        | +  | ..        | +  | ..           | ..           |
| D(1,1049) | D(2,1049) | .. | D(X,1049) | .. | D(1679,1049) | D(1680,1049) |
| D(1,1050) | D(2,1050) | .. | D(X,1050) | .. | D(1679,1050) | D(1680,1050) |

## 6.BLOCK DIAGRAM





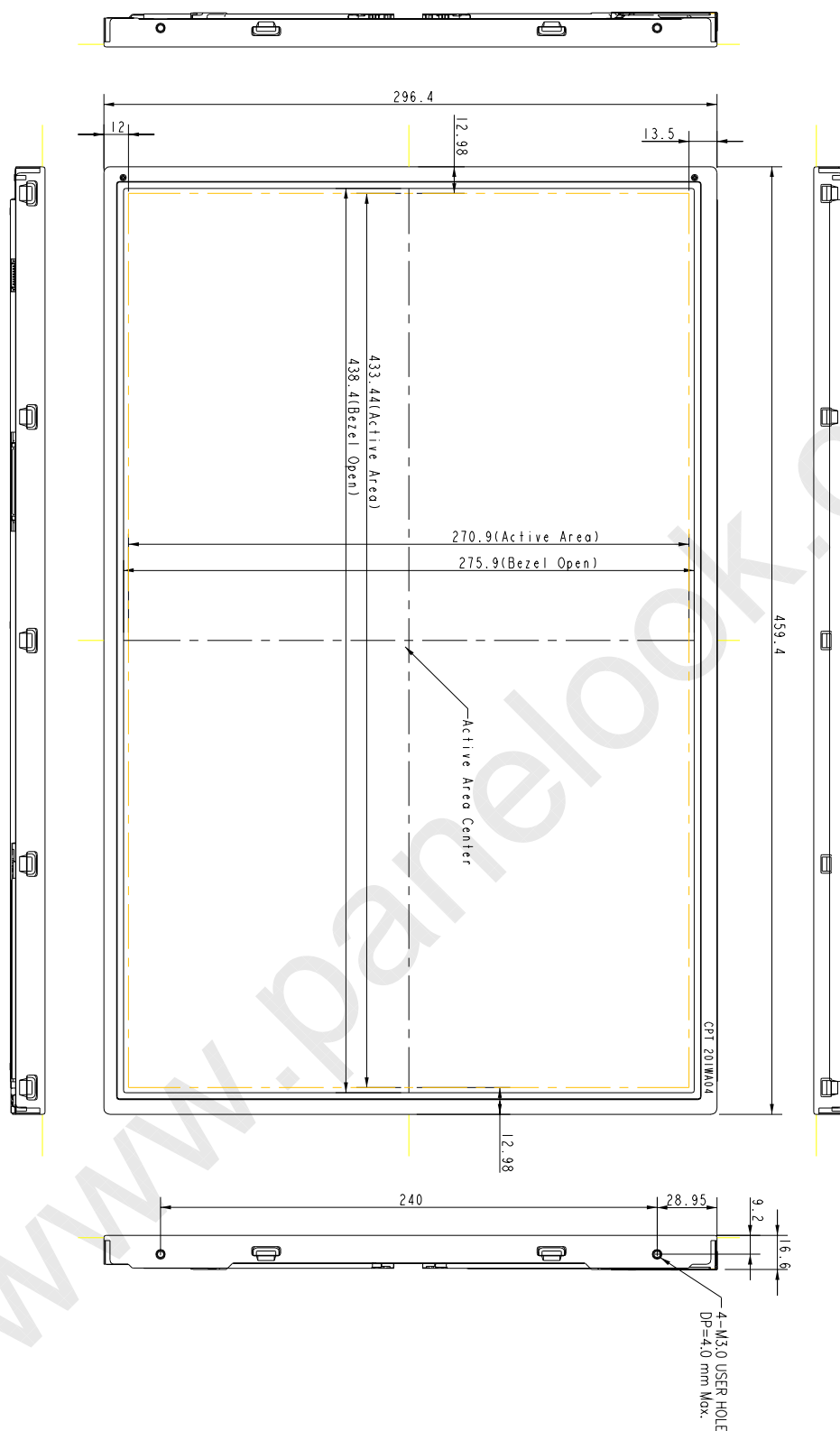
CPT

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## 7.MECHANICAL SPECIFICATION

(1) Front side (Tolerance is  $\pm 0.5\text{mm}$  unless noted)

[Unit:mm]





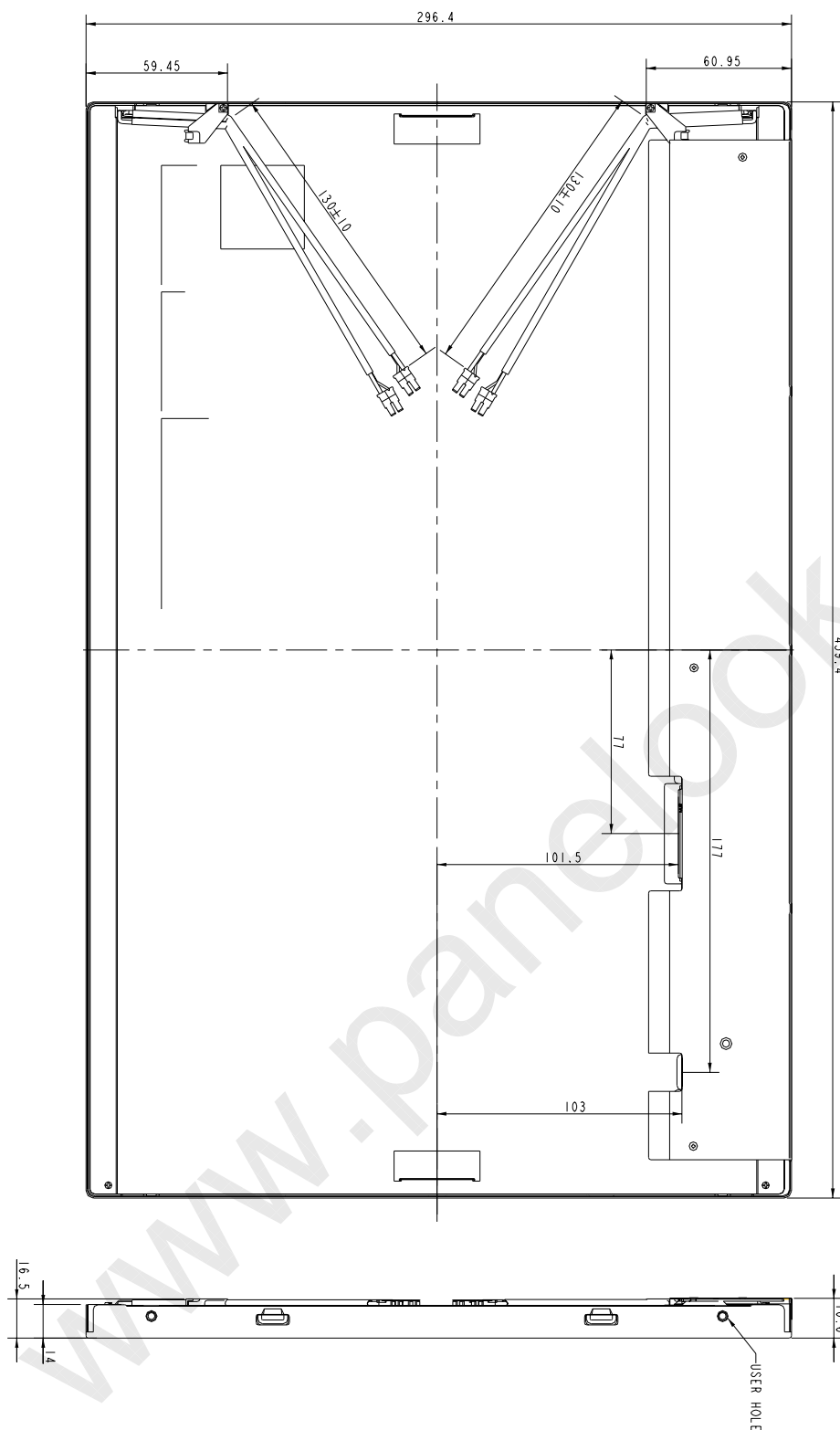


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(2)Rear side (Tolerance is  $\pm 0.5\text{mm}$  unless noted)

[Unit: mm]



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## 8. OPTICAL CHARACTERISTICS

Ta=25°C , VCC=5.0V

| ITEM              |            | SYMBOL     | CONDITION                 | MIN.  | TYP.  | MAX.  | UNIT              | REMARK |
|-------------------|------------|------------|---------------------------|-------|-------|-------|-------------------|--------|
| Contrast (CEN)    |            | CR         | $\theta = \phi = 0^\circ$ | 600   | 1000  | --    | --                | *1)    |
| Luminance (CEN)   |            | L          | $\theta = \phi = 0^\circ$ | 200   | 300   | --    | cd/m <sup>2</sup> | *2)    |
| 9P Uniformity     |            | $\Delta L$ | $\theta = \phi = 0^\circ$ | 75    | 80    | --    | %                 | *2)    |
| Response Time     |            | Tr+Tf      | $\theta = \phi = 0^\circ$ | --    | 5     | 12    | ms                | *4)    |
| Cross talk        |            | CT         | $\theta = \phi = 0^\circ$ | 0     | --    | 1.5   | %                 | *5)    |
| View angle        | Horizontal | $\phi$     | $CR \geq 10$              | 150   | 170   | --    | Deg.              | *3)    |
|                   | Vertical   | $\theta$   |                           | 140   | 160   | --    | Deg.              |        |
|                   | Horizontal | $\phi$     | $CR \geq 5$               | 150   | 170   | --    | Deg.              |        |
|                   | Vertical   | $\theta$   |                           | 150   | 170   | --    | Deg.              |        |
| Color Coordinates | White      | x          | $\theta = \phi = 0^\circ$ | 0.283 | 0.313 | 0.343 | --                | *2)    |
|                   |            | y          |                           | 0.299 | 0.329 | 0.359 |                   |        |
|                   | Red        | x          |                           | 0.621 | 0.651 | 0.681 |                   |        |
|                   |            | y          |                           | 0.303 | 0.333 | 0.363 |                   |        |
|                   | Green      | x          |                           | 0.247 | 0.277 | 0.307 |                   |        |
|                   |            | y          |                           | 0.584 | 0.614 | 0.644 |                   |        |
|                   | Blue       | x          |                           | 0.115 | 0.145 | 0.175 |                   |        |
|                   |            | y          |                           | 0.052 | 0.082 | 0.112 |                   |        |
| Gamma             |            | $\gamma$   | VESA                      | 2.0   | 2.2   | 2.4   | --                | *6)    |

## [Note]

These items are measured using BM-7 (TOPCON) under the dark room condition (no ambient light).

Measurement Condition: IL=7.0mA × 4

Inverter: Sumida, model: IV50167/T — — , Frequency=50kHz.

Definition of these measurement items is as follows:

## \*1) Definition of Contrast Ratio

CR=ON (White) Luminance/OFF (Black) Luminance

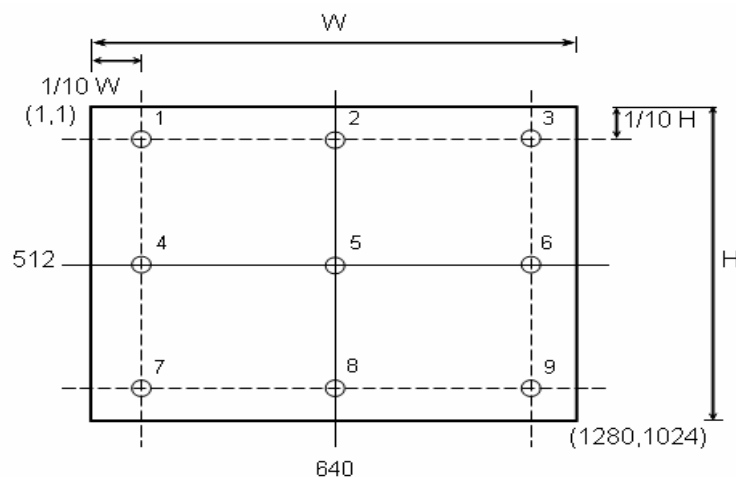
## \*2) Definition of Luminance and Luminance uniformity

Central luminance: The white luminance is measured at the center position "5" on the screen, see Fig.1 below. And the measure time is 30 min after discharged.

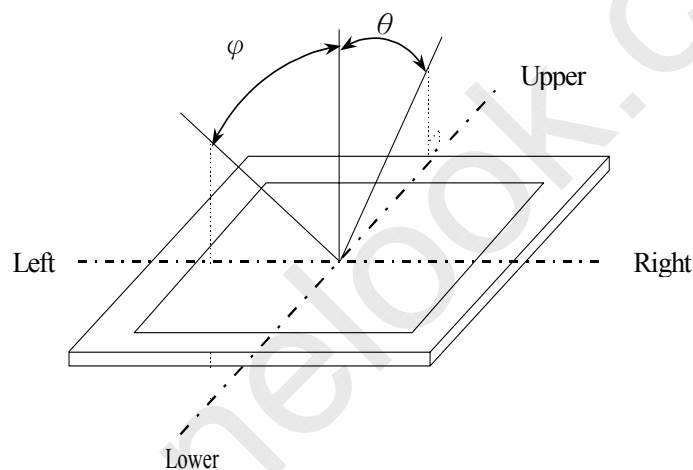
5P Luminance (AVG): The white luminance is measured at measuring points 10、11、5、12、13, see Fig.1 below.

9P Luminance (AVG): The white luminance is measured at measuring points 1 to 9, see Fig.1 below.

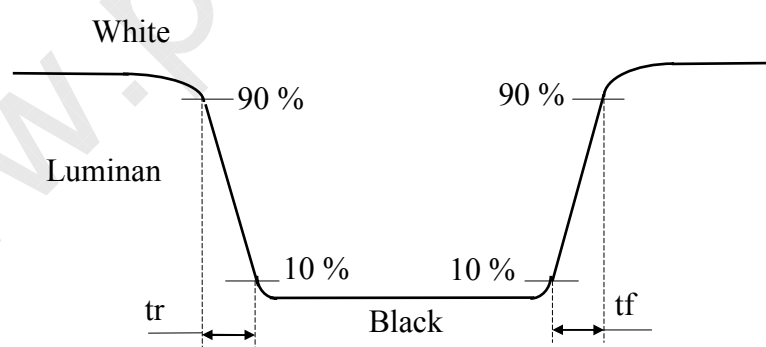
9P Uniformity:  $\Delta L = (L_{MIN} / L_{MAX}) \times 100\%$



### 3). Definition of Viewing Angle( $\theta, \psi$ ):



### \*4) Definition of Response Time:

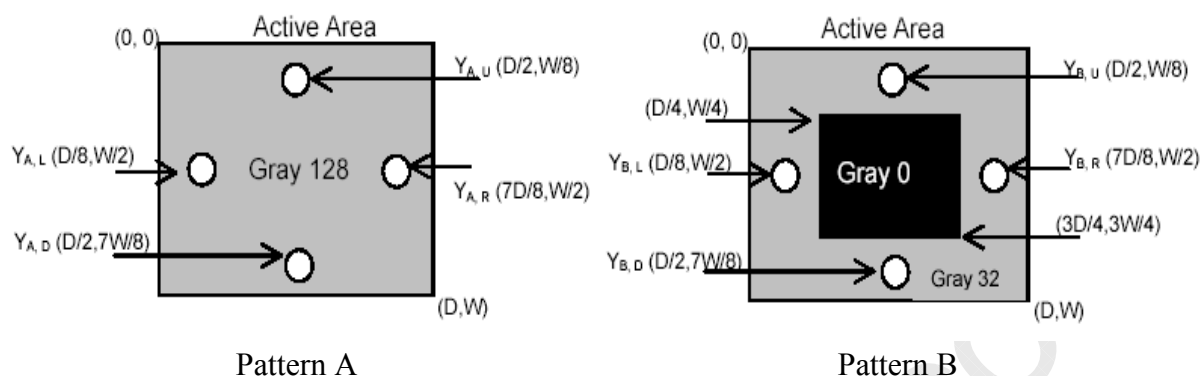
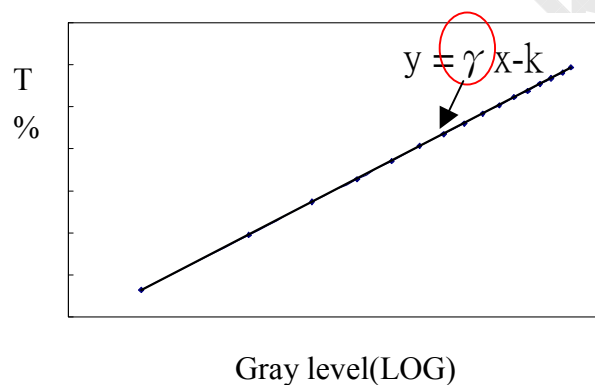


## 5) Definition of crosstalk:

$$CT = |Y_B - Y_A| / Y_A \times 100 (\%)$$

$Y_A$ : The luminance of measured position at pattern A

$Y_B$ : The luminance of measured position at pattern B with Gray level 0

6) Definition of Gamma ( $\gamma$ ), follow VESA standard sampling every 16 gray level (0, 16, 32, ..., 224, 240, 255)



## 9.RELIABILITY TEST CONDITIONS

### (1) Temperature and Humidity

| TEST ITEMS                                  | CONDITIONS                                     |
|---------------------------------------------|------------------------------------------------|
| HIGH TEMPERATURE<br>HIGH HUMIDITY OPERATION | 50℃ ; 90%RH; 240h<br>(No condensation)         |
| HIGH TEMPERATURE<br>HIGH HUMIDITY STORAGE   | 60℃ ; 90%RH;48h<br>(No condensation)           |
| HIGH TEMPERATURE OPERATION                  | 50℃ ; 240h                                     |
| HIGH TEMPERATURE STORAGE                    | 60℃ ; 240h                                     |
| LOW TEMPERATURE OPERATION                   | 0℃ ; 240h                                      |
| LOW TEMPERATURE STORAGE                     | -20℃ ; 240h                                    |
| THERMAL SHOCK                               | BETWEEN -20℃ (1hr)AND 60℃ (1hr); 100<br>CYCLES |

### (2) Shock & Vibration

| ITEMS                        | CONDITIONS                                                                                                                                                                                                                                                                              |
|------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| SHOCK<br>(NON-OPERATION)     | Shock level:100G<br>Waveform: half sinusoidal wave, 2ms<br>Number of shocks: one shock input in each direction of three<br>mutually perpendicular axes for a total of six shock inputs                                                                                                  |
| VIBRATION<br>(NON-OPERATION) | Vibration level: 9.8m/s <sup>2</sup> (1.0G) zero to peak<br>Waveform: sinusoidal<br>Frequency range: 5 to 500 Hz<br>Frequency sweep rate: 0.5 octave/min<br>Duration: one sweep from 5 to 500Hz in each of three mutually<br>perpendicular axis(each x,y,z axis: 1 hour, total 3 hours) |

### (3) ESD

| POSITION  | CONDITION( MDL turn off)                                                                                                      |
|-----------|-------------------------------------------------------------------------------------------------------------------------------|
| Connector | 1. 200 pF , 0 Ω , ±250 V<br>2. contact mode for each pin                                                                      |
| Module    | 1. 150 pF , 330 Ω , ±15K V<br>2. Air mode, test 25 times for each test point<br>3. Contact mode, 25 times for each test point |

### (4) Low Presure test

| TEST ITEM                  | CONDITION                  |
|----------------------------|----------------------------|
| Low Pressure test(storage) | 260HPa (30000 ft.) ; 24 Hr |

### (5) Judgment standard

The judgment of the above test should be made as follow:

Pass: Normal display image with no obvious non-uniformity and no line defect. Partial transformation of the module parts should be ignored.

Fail: No display image, obvious non-uniformity, or line defects.



## 10. HANDLING PRECAUTIONS FOR TFT-LCD MODULE

Please pay attention to the followings in handling- TFT-LCD products;

### (1) ASSEMBLY PRECAUTION

- 1) Please use the mounting hole on the module side in installing and do not beading or wrenching LCD in assembling. And please do not drop, bend or twist LCD module in handling.
- 2) Please design display housing in accordance with the following guide lines.
  - a) Housing case must be destined carefully so as not to put stresses on LCD all sides and not to wrench module. The stresses may cause non-uniformity even if there is no non-uniformity statically.
  - b) Keep sufficient clearance between LCD module back surface and housing when the LCD module is mounted. Approximately 1.0 mm of the clearance in the design is recommended taking into account the tolerance of LCD module thickness and mounting structure height on the housing.
  - c) When some parts, such as, FPC cable and ferrite plate, are installed underneath the LCD module, still sufficient clearance is required, such as 0.5mm. This clearance is, especially, to be reconsidered when the additional parts are implemented for EMI countermeasure.
  - d) Design the inverter location and connector position carefully so as not to give stress to lamp cable, or not to interface the LCD module by the lamp cable.
  - e) Keep sufficient clearance between LCD module and the others parts, such as inverter and speaker so as not to interface the LCD module. Approximately 1.0mm of the clearance in the design is recommended.
- 3) Please do not push or scratch LCD panel surface with any-thing hard. And do not soil LCD panel surface by touching with bare hands. (Polarizer film, surface of LCD panel is easy to be flawed.)
- 4) Please do not press any parts on the rear side such as source TCP, gate TCP, control circuit board and FPCs during handling LCD module. If pressing rear part is unavoidable, handle the LCD module with care not to damage them.
- 5) Please wipe out LCD panel surface with absorbent cotton or soft cloth in case of it being soiled.
- 6) Please wipe out drops of adhesives like saliva and water on LCD panel surface immediately. They might damage to cause panel surface variation and color change.
- 7) Please do not take a LCD module to pieces and reconstruct it. Resolving and reconstructing modules may cause them not to work well.
- 8) Please do not touch metal frames with bare hands and soiled gloves. A color change of the metal frames can happen during a long preservation of soiled LCD modules.
- 9) Please pay attention to handling lead wire of backlight so that it is not tugged in connecting with inverter.



## (2) OPERATING PRECAUTIONS

- 1) Please be sure to turn off the power supply before connecting and disconnecting signal input cable.
- 2) Please do not change variable resistance settings in LCD module. They are adjusted to the most suitable value. If they are changed, it might happen LCD does not satisfy the characteristics specification.
- 3) Please consider that LCD backlight takes longer time to become stable of radiation characteristics in low temperature than in room temperature.
- 4) A condensation might happen on the surface and inside of LCD module in case of sudden change of ambient temperature.
- 5) Please pay attention to displaying the same pattern for very long time. Image might stick on LCD. If then, time going on can make LCD work well.
- 6) Please obey the same caution descriptions as ones that need to pay attention to ordinary electronic parts.

## (3) PRECAUTIONS WITH ELECTROSTATICS

- 1) This LCD module use CMOS-IC on circuit board and TFT-LCD panel, and so it is easy to be affected by electrostatics. Please be careful with electrostatics by the way of your body connecting to the ground and so on.
- 2) Please remove protection film very slowly on the surface of LCD module to prevent from electrostatics occurrence.

## (4) STORAGE PRECAUTIONS

- 1) When you store LCDs for a long time, it is recommended to keep the temperature between 0°C ~40°C without the exposure of sunlight and to keep the humidity less than 90%RH.
- 2) Please do not leave the LCDs in the environment of high humidity and high temperature such as 60°C 90%RH.
- 3) Please do not leave the LCDs in the environment of low temperature; below -20°C.

## (5) SAFETY PRECAUTIONS

- 1) When you waste LCDs, it is recommended to crush damaged or unnecessary LCDs into pieces and wash them off with solvents such as acetone and ethanol, which should later be burned.
- 2) If any liquid leaks out of a damaged-glass cell and comes in contact with the hands, wash off thoroughly with soap and water.

## (6) OTHERS

- 1) A strong incident light into LCD panel might cause display characteristics' changing inferior because of polarizer film, color filter, and other materials becoming inferior. Please do not expose LCD module direct sunlight and strong UV rays.
- 2) Please pay attention to a panel side of LCD module not to contact with other materials in preserving it alone.
- 3) For the packaging box, please pay attention to the followings:
  - a) Packaging box and inner case for LCD are designed to protect the LCDs from the damage or scratching during transportation. Please do not open except picking LCDs up from the box.



- b) Please do not pile them up more than 5 boxes. (They are not designed so.) And please do not turn over.
- c) Please handle packaging box with care not to give them sudden shock and vibrations. And also please do not throw them up.
- d) Packing box and inner case for LCDs are made of cardboard. So please pay attention not to get them wet. (Such like keeping them in high humidity or wet place can occur getting them wet.)